

## Waves

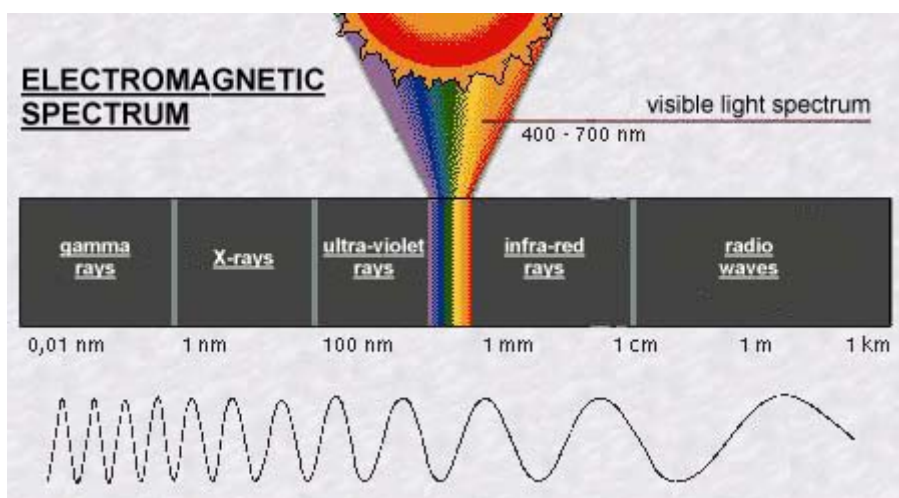
### 8-6 The student will demonstrate an understanding of the properties and behaviors of waves. (Physical Science)

#### 8-6.8 Compare the wavelength and energy of waves in various parts of the electromagnetic spectrum (visible light, infrared, and ultraviolet radiation).

**Taxonomy level:** 2.6-B Understand Conceptual Knowledge

**Previous/Future knowledge:** Students have not been introduced to the concept of the electromagnetic spectrum in previous grades. Students are introduced to the concept of electromagnetic waves in this unit in 8<sup>th</sup> grade (8-6.2). Students will further develop the concept of quantitative relationships in properties of waves in high school Physical Science (PS-7.5).

**It is essential for students to know** that electromagnetic waves have a wide range of wavelengths. The entire range of wavelengths is called the *electromagnetic spectrum*. The relationship between the wavelength and energy of waves in various parts of the electromagnetic spectrum can be shown as follows:



[http://molaire1.club.fr/e\\_quantic.html](http://molaire1.club.fr/e_quantic.html)

#### *Visible light*

- *Visible light* is the range of electromagnetic waves that can be detected by the human eye.
- The entire range of visible light is called the *visible light spectrum*.
- The wavelengths of visible light are in the middle range of *wavelengths/frequencies* of electromagnetic waves.
- The longer the wavelength, the lower the energy of the wave is.
- The human eye reacts to different energies and frequencies of light so that different colors are seen.
  - Higher frequencies (shorter wavelengths) are perceived as colors toward the blue-violet range and have higher energy.
  - Lower frequencies (longer wavelengths) are perceived as colors toward the orange-red range and have lower energy.

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#### *Infrared radiation*

- *Infrared radiation* is the range of electromagnetic waves with frequencies lower than red on the visible spectrum, thereby having longer wavelengths and less energy than red wavelengths.
- All objects emit infrared radiation, and hotter objects emit more infrared radiation than cooler objects.
- Heat energy is transmitted by infrared radiation.
- When objects absorb infrared radiation, they become warmer.

#### *Ultraviolet radiation*

- *Ultraviolet radiation* is the range of electromagnetic waves with frequencies higher than violet on the visible spectrum, thereby having shorter wavelengths and more energy than violet wavelengths.
- Because of the high energy of ultraviolet radiation, too much exposure is damaging to the eyes and skin.

**It is not essential for students to** know the specific wavelengths of the various types of electromagnetic radiation, nor do students have to know the relative wavelengths and energies of other forms of radiation than visible light, infrared, and ultraviolet radiation.

#### **Assessment Guidelines:**

The objective of this indicator is to *compare* the wavelength and energy of waves in specific parts of the electromagnetic spectrum; therefore, the primary focus of assessment should be to detect similarities and differences related to wavelengths (and therefore frequency) and the energy of infrared, visible, light and ultraviolet waves. However, appropriate assessments should also require students to *recognize* specific parts of the electromagnetic spectrum that are higher or lower in energy, shorter or longer in wavelengths, and higher or lower in frequency; *interpret* a diagram of the electromagnetic spectrum; *infer* which specific parts are higher or lower in wavelength, energy, and frequency; or *classify* waves by specific characteristics.